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ABSTRACT

Researchers on the Lasting Benefits Study (LBS) are tracking students who participated in Tennessee's K-3 Student/Teacher Achievement Ratio (STAR) Project (1985-89) as they continue into later grades. Project STAR was a statewide experiment conducted to demonstrate the effects of reduced student/teacher ratios (15:1) on student achievement (reading and mathematics) and development (e.g., self-concept, discipline, and attendance). Students in smaller classes outperformed students in larger classes in all grades (K-3). This paper presents student achievement results from fourth grade, the first year that students went from small (15:1) to regular (25:1) classes. Multivariate analysis of variance for LBS revealed that the positive effects from involvement in a small-size class remained significant 1 full year after students returned to regular-size classes. Students who previously were in small-size STAR classes demonstrated that they continued to have statistically significant advantages over students who had been in the other two class types (regular and regular-with-aide) on every set of measurements and across all school locations (innercity, rural, suburban, and urban). (6 figures, 7 tables, 14 references) (Author/MLF)

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FIVE YEARS OF SMALL-CLASS RESEARCH: STUDENT BENEFITS DERIVED FROM REDUCED STUDENT/TEACHER RATIOS

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Center of Excellence for Research in Basic Skills
Lasting Benefits Study

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ABSTRACT

Researchers on the Lasting Benefits Study (LBS) are tracking students who participated in Tennessee's K-3 class-size study (STAR, 1985-1989) as they continue into later grades. Project STAR was a statewide experiment conducted to demonstrate the effects of reduced student/teacher ratios (15:1) on student achievement (reading and mathematics) and development (e.g., self concept, discipline, attendance). Students in smaller classes (15:1) outperformed students in larger classes in all grades (K-3). This paper presents student achievement results from fourth grade, the first year that students went from small (15:1) to regular (25:1) classes.

The MANOVA analysis for LBS revealed that the positive effects from involvement in a small-size class remained significant one full year after students returned to regular-size classes. Students who previously were in small-size STAR classes demonstrated that they continued to have statistically significant ($p \leq .01$) advantages over students who had been in the other two class types (regular and regular-with-aide) on every set of measurements and across all school locations (Inner-city, Rural, Suburban, Urban).

Table of Contents

Building a Collaborative Base 3

Summary of Project STAR Analysis 3

The Lasting Benefits Study (LBS): Continuing Collaboration 4

The Fourth-Grade Data Base and Design 4

The LBS Measurement Processes 4

Table 1 Lasting Benefits Study: Fourth Grade (1989-90) Number and Percent of White and Minority Students by Class Type and Location 5

Fourth Grade Analysis Procedures 6

Table 2 Lasting Benefits Study: Fourth Grade (1989-90) Analysis of Variance Source Table 6

The LBS Fourth Grade Results 7

Table 3 - Lasting Benefits Study: Fourth Grade (1989-90) - Summary of Class Effects Analysis Using Mean Scores of Sets 7

Table 4 - Lasting Benefits Study: Fourth Grade (1989-90) - Mean Number of Domains Mastered in Mathematics and Language Arts by Class Type by School Type 8

Table 5 Lasting Benefits Study: Fourth Grade (1989-90) Tennessee Comprehensive Assessment Program (TCAP) Mean Scaled Scores by Race and Class Type 9

Summary and Conclusions 9

Table 6 - Lasting Benefits Study: Fourth Grade (1989-90) - Scaled Score Differences and the Differences in the Mean Number of Domains Mastered Between Small and Regular Class Students and Between Regular/Aide and Regular Class Students 10

Table 7 - Lasting Benefits Study: Fourth Grade (1989-90) - Summary of Estimates of Small Class and Regular/Aide Effect Sizes 11

Some Speculative Conclusions 11

Potential for Further Analyses 12

References 13

Appendix A. Definition of School Type 14

Appendix B. Lasting Benefits Study: Fourth Grade (1989-90) Mean Scores from the Tennessee Comprehensive Assessment Program 15

Appendix C. Figures 1-6 Graphical Representation of TCAP Fourth Grade Results 16

FIVE YEARS OF SMALL-CLASS RESEARCH: STUDENT BENEFITS DERIVED FROM REDUCED STUDENT/TEACHER RATIOS: GRADE-FOUR RESULTS

Building a Collaborative Base (Project STAR)

The Student/Teacher Achievement Ratio (STAR) Project was a major longitudinal class-size study funded by the Tennessee (TN) legislature to determine the effects of reduced class size on student achievement for the early primary grades (K-3). STAR was a four-year study (1985-1989) of sufficient power to allow the class to be the unit of analysis with three classroom conditions: a small class (S) with a teacher/student ratio of 13:1 to 17:1 (average 15:1), a regular (R) class at 22:1 to 26:1 (average 24:1) and a regular class with a full-time teacher aide (RA). An in-school design (all participating schools had at least one class of each type) was employed to control for school and school district differences.

The Tennessee State Department of Education (State Education Agency, or SEA) organized the study and formed a research consortium. An experienced elementary principal was employed as the project/consortium director. The consortium included personnel from four Tennessee Institutions of Higher Education (IHEs) and a representative from both the State Board of Education and from the State Superintendents' Association. The project included 42 school systems (Local Education Agencies, or LEAs), over 6,000 students, over 300 teachers, and over 100 teacher aides during each year of the four-year study. Collaboration among the SEAs, LEAs, and the IHEs was essential for the successful completion of the study. Project personnel worked with an advisory board of experts and a nationally-prominent consultant, who had responsibility for design and analysis.

Data included information concerning student achievement and development, class demographics, and other variables which might have affected student achievement. Student tests included the Stanford Achievement Test (SAT), Tennessee's Basic Skills First (BSF) test, and The Self-Concept and Motivation Inventory (SCAMIN). Teacher, administrator, school, and class demographic information was collected. Eight additional instruments were employed to assess factors and conditions (e.g., grouping practices, parent involvement), other than class size, that may have influenced students' achievement and/or development.

Each university-based staff was responsible for providing their assigned schools with information, for collecting data, for observing testing conditions, and for conducting other field activities. The decentralized communication structure encouraged consortium members to form productive relationships through frequent contact with practitioners (i.e., system superintendents, principals, teachers, etc.). This collaborative spirit fostered the successful collection of the monumental amount of data.

Summary of Project STAR Analysis

Analysis of the STAR data, using multivariate ANOVAs for an unbalanced design, showed that small classes consistently outperformed regular and regular/aide classes on all sub-scales of both achievement measures (SAT and BSF). In each year of the study (1985-1989) starting in kindergarten and going through grade 3 the small-class effect was statistically significant ($p \leq .01$) in all contrasts. The results were constant when controlling for teacher variables (training, sex, race, etc.), for school location (rural, urban, suburban, inner-city), and for student variables (sex, race, SES, etc.). Results were all the more impressive when considering that Project STAR was a large-scale experiment employing a true random design and a conservative analysis.

STAR's tight design has allowed researchers to make strong, positive statements about the impact of small classes on student learning, such as: "This experiment yields unambiguous evidence of a significant class-size effect," (Finn et al., 1990, p. 135) and "This research leaves no doubt that small classes have an advantage over larger classes in reading and mathematics in the early primary grades." (Finn and Achilles, 1990, p. 573).

Project STAR results have had direct effects for several Tennessee school systems and other systems throughout the country. The Memphis City School System allocated Chapter I funds for reducing class sizes. Similarly, ten low-income, rural systems agreed to use their Chapter I funds for class-size reduction (1989-92). Parent organizations, teacher associations, and educational administrators from more than nine states have requested STAR results to provide evidence in an effort to prompt legislation for reduced class-size programs. Further, the TN SEA has granted funds to Tennessee State University (TSU) to study the effects of reduced class

sizes in selected rural, poor LEAs throughout the state. Additionally, the positive results from STAR and the unique, massive database generated during the original four years of the study have prompted the SEA to request TSU researchers to direct a study of residual or carry-over effects for students who were in a small class (15:1) during STAR, and who have now returned to "regular"-size classes.

The Lasting Benefits Study (LBS): Continuing Collaboration

The Lasting Benefits Study (LBS) is the longitudinal follow-up study of Project STAR. The LBS is being conducted to determine if there are continuing effects or achievement benefits for STAR students after they return to regular-size classes (e.g. 25 to 1 or so). The LBS fourth-grade sample contained 4,230 students in 216 classes. These students had participated in STAR during the third grade (they may or may not have been STAR participants in previous grades due to student mobility).

The LBS lacks the full design strength of STAR (i.e., a random-assignment experiment), which allowed such analysis benefits as convenient use of the class (i.e., the class average) as the unit of measure. This design strength of STAR was important for independence and for considering "teacher effects." However, the standard practice in much research is simply to consider each student's outcomes as the unit of measure and the unit of analysis. The LBS analysis used a compromise of these two extremes. Only classrooms containing former STAR students were analyzed. These students were grouped for analysis within each fourth grade class and according to their previous STAR class type. This use of groups-within-class mean scores will become more tenuous as students progress through the system considering the percent of former STAR students in any given class will probably diminish, and the number of classrooms containing STAR students will increase. Data for LBS grade-four analysis were gathered during the 1989-90 school year; the grade-five data were collected during 1990-91, and in spring 1992 the grade-six data will be available. Tracking the student sample, data collection and analysis continue to be major longitudinal concerns.

The Fourth-Grade Data Base and Design

Table 1 shows the data base for grade-four analysis. Of the total (n= 4230), 20.2 percent were minority. (Testing changes required the exclusion of one large group of students which included a high percent of minority students; these students will be included in the grade-five analysis). The three class types (S, R, RA) are represented by nearly equal numbers of students (S= 1412; R= 1250; RA= 1568). The students were in four "locations": Inner-city (n=326), suburban (n=1055), Rural (n=2592) and Urban (n=257). These four designations of location were determined in Project STAR. **Appendix A** provides information on the criteria for determining "location."

LBS researchers were interested in student achievement relative to location (urban, rural, etc.), grade 3 class type assignment (S, R, RA), with the most important question being, "Do students who received the benefits of being in a small class condition (as shown in STAR), and who were in a small class at least in grade three (1988-89) retain any of those benefits after being in a "regular" (1:25 or so) class for one year (grade 4), for two years (grade 5), and for three years (grade 6)?" This paper reports grade-four results.

The LBS Measurement Processes

During Project STAR (1985-89), school systems used the SAT and BSF achievement tests. Beginning with the 1989-90 school year, the first year of the LBS, TN instituted a new test battery, the TN Comprehensive Assessment Program (TCAP). There are no direct means to conduct statistical comparisons between STAR K-3 achievement test scores and LBS achievement test scores. The LBS uses a cross-sectional analysis of fourth-grade achievement scores between class types and school locations.

One school system only tested a select sample of their school population during the first year of TCAP implementation. As a result, 17 Project STAR schools did not administer the TCAP test battery during the 1989-90 school year, and students from these schools could not be participants in the fourth-grade LBS.

Table 1

Lasting Benefits Study: Fourth Grade (1989-90)

Numbers and Percent of White and Minority Students
by Class Type and Location

CLASS TYPE

LOCATION	Small			Regular			Regular-with-Aide			TOTAL		
	White	Minority	Total	White	Minority	Total	White	Minority	Total	White	Minority	Total
Inner-City	11 (9.6%)	103 (90.4%)	114 (100%)	7 (7.7%)	84 (92.3%)	91 (100%)	9 (7.4%)	112 (92.6%)	121 (100%)	27 (8.3%)	299 (91.7%)	326 (100%)
Suburban	220 (70.7%)	91 (29.3%)	311 (100%)	227 (65.6%)	119 (34.4%)	346 (100%)	246 (61.8%)	152 (38.2%)	398 (100%)	693 (65.7%)	362 (34.3%)	1055 (100%)
Rural	818 (92.8%)	63 (7.2%)	881 (100%)	719 (94.6%)	41 (5.4%)	760 (100%)	895 (94.1%)	56 (5.9%)	951 (100%)	2432 (93.8%)	160 (6.2%)	2592 (100%)
Urban	88 (83.0%)	18 (17.0%)	106 (100%)	44 (83.0%)	9 (17.0%)	53 (100%)	91 (92.9%)	7 (7.1%)	98 (100%)	223 (86.8%)	34 (13.2%)	257 (100%)
TOTAL	1137 (80.5%)	275 (19.5%)	1412 (100%)	997 (79.8%)	253 (20.2%)	1250 (100%)	1241 (79.1%)	327 (20.9%)	1568 (100%)	3375 (79.8%)	855 (20.2%)	4230 (100%)

This decrease in the LBS fourth-grade sample reduced the percentage of minority (non-white) students. However, the 17 exempt schools began to administer the TCAP in the 1990-91 school year, and these students will be included in future LBS analyses.

The TCAP test battery includes both a norm-referenced test (NRT) component and criterion-referenced test (CRT) component. The Comprehensive Tests of Basic Skills (CTBS/4) constituted the NRT component. The CTBS/4, published by CTB/McGraw Hill, was nationally normed in 1988. The NRT component indicates students' proficiencies in the areas of reading, language, mathematics, study skills, science, and social science. The CRT component was customized for TN to assess students' skill levels attained from the state's mathematics and language arts curriculum. The CRT component indicates students' mastery levels (i.e., mastery, partial mastery, or non-mastery) regarding the language arts and mathematics content domains. Mastery means that the student has correctly answered at least 75% of the items in a domain. Partial mastery means competence was exhibited for 50-74% of the items, and non-mastery represents scoring correctly for fewer than 50% of the items. The seven language arts content domains are: language mechanics, language usage, sentence and paragraph structure skills, spelling and word identification, reading comprehension, literary skills, and reference study skills. The eight mathematics content domains are: numeration, whole number operations, fractions, decimals, graphs and tables, measurement, geometry, and problem solving and applications (TN Comprehensive Curriculum Objectives, 1989).

Fourth Grade Analysis Procedures

Scaled score means for the three STAR class types (S, R, RA) were compared through multivariate analysis of variance (MANOVA) for unequal n's using the MULTIVARIANCE program (Finn and Bock, 1985). The analysis examined the mean differences among the class types, the mean differences among the four school locations (rural, urban, suburban, inner city), and the interaction between class types and locations. The MANOVA model controlled for school location (a fixed effect) and classes (a random effect). The sources of variation are depicted in **Table 2**.

Table 2
Lasting Benefits Study: Fourth Grade (1989-90)
Analysis of Variance Source Table

Fixed Effects	Error Term
Location	C
Class Type	CT
Location x Class Type	CT
Random Effects	
Classes within Locations (C)	
Classes x Class Type	
Students within Classes and Class Types	

Using the basic STAR analysis design, student scores from three achievement subsets for the LBS were compared separately using MANOVA. Two of the subsets included scores from both the NRT and the CRT components of the TCAP. Set 1 included Total Reading and Total Language (NRT scores) and the number of domains mastered in Language Arts (CRT). Set 2 consisted of Total Math, Total Science (NRT scores), and the

number of domains mastered in Mathematics (CRT). Set 3 included Study Skills and Social Science (NRT scores). Overall MANOVAs were followed by F-ratios for those effects that were significant, and by Hotelling's T^2 and univariate t-tests for two particular contrasts: (1) Small class vs. Regular class (S vs R) and (2) Regular-with-Aide class vs. Regular class (RA vs R). A contrast of S vs RA was not conducted because no mean differences were found between R and RA kindergarten classes, and further because R and RA students were randomly interchanged between these two class types before grade one due to teacher-identified discipline problems and some parent complaints. This is the only year that reassignment occurred.

The LBS Fourth Grade Results

The LBS analysis yielded clear and consistent results concerning the NRT and the CRT scores. **Students who previously were in a small-size STAR class demonstrated that they had statistically significant ($p \leq .01$) advantages over students in R and RA class types on every set of measurements. These results were found to be consistent across all school locations.** Table 3 shows the probability ("p") values for the three multivariate sets. For the small/regular contrast, every variable was significant ($p \leq .01$) and every variable set was significant ($p \leq .001$), and for the regular/regular-aide contrast, no variable or variable set was significant. The differences, always favoring the small class, between small and regular classes ranged from .11 to .16 standard deviation units (effect size).

Table 3

Lasting Benefits Study: Fourth Grade (1989-90)
TN Comprehensive Assessment Program (TCAP)
Summary of Class Effects Analysis Using Mean Scores of Sets*

Multivariate Analysis of Variance Probability Values		Set 1 Verbal	Set 2 Math/Science	Set 3 Social Science/ Study Skills
Location	(Inner-City, Suburban, Urban, and Rural)	$P \leq .001$	$P \leq .001$	$P \leq .001$
Class Type	(Small, Regular, and Regular/Aide)	$P \leq .001$	$P \leq .001$	$P \leq .001$
Location by Class Type Interaction		NS	NS	NS

Discussion

[Location] Significant location differences on all sets (norm-referenced tests and criterion-referenced tests combined) and on each measure separately (norm-referenced tests and criterion-referenced tests individually) due almost entirely to lower performance of inner-city schools. See means in **Table 4** (criterion-referenced tests) and **Appendix B** (norm-referenced tests).

[Class Type] Regular vs. Regular/Aide contrast -- no significant differences on separate variables or set combinations. Small vs. Regular contrast -- every separate variable and combined set were significant at $p < .01$ or better.

[Location by Class Type Interaction] No significant interaction: Class type differences are the same in all four locations. There was no differential (compounding) effect across class type vs. location.

* Set 1 included scaled scores from NRT Total Reading, Total Language, and the number of domains mastered in CRT Language Arts. Set 2 consisted of NRT Total Math, Total Science, and the number of domains mastered in CRT Mathematics. Set 3 included NRT Study Skills and Social Science scores.

Table 4 shows the mean number of domains mastered in reading and mathematics from the CRT component by class type and by school location. Of the eight mathematics domains, small-class (S) students mastered an average of 4.05; R students mastered an average of 3.70 and RA students an average of 3.61. Of the seven language arts domains, S-class students mastered an average of 4.12, R-class students an average of 3.87, and RA students mastered an average of 3.69.

Table 4

Lasting Benefits Study: Fourth Grade (1989-90)
TN Comprehensive Assessment Program (TCAP), Criterion-Reference Test Component
Mean Number of Domains Mastered in Mathematics and Language Arts*
by Class Type by School Type

School Type	Class Type: Small		Regular		Regular/Aide	
	Mathematics	Language Arts	Mathematics	Language Arts	Mathematics	Language Arts
Inner-City	2.77	2.68	1.94	1.98	2.34	2.07
Suburban	4.32	4.43	3.78	4.10	3.44	3.73
Rural	4.13	4.19	3.90	4.00	3.88	3.90
Urban	3.94	4.20	3.38	3.88	3.33	3.65
All	**4.05**	**4.12**	**3.70**	**3.87**	**3.61**	**3.69**

*The 8 **Mathematics domains** are: numeration, whole number operations, fractions, decimals, graphs and tables, measurements, geometry, and problem solving and applications. The 7 **Language Arts domains** are: language mechanics, language usage, sentence and paragraph structure, spelling and word identification, reading comprehension, literary skills, and reference study skills.

Appendix B contains tables showing that S-class students outperformed students from R and RA classes on the six NRT sub-scales and across all four school-type locations. The students from suburban S classes achieved higher scaled scores than students from the other three locations. These tables provide the exact scaled score means for each reported TCAP sub-scale by class type, by school location, and by race. The greatest achievement advantages were for inner-city and suburban classes. **Appendix C** graphically presents the mean scaled scores and the respective percentile ranks for the TCAP results.

On the **TCAP Total Reading sub-scale**, of the four locations (inner-city, rural, urban, suburban) inner-city students had the lowest scaled scores. Of the three class types, students who were in small classes always scored higher ($p \leq .01$) than students who had been in R and RA classes. Within the inner-city locations, S-class students scored above their R and RA counterparts. S-class inner-city students had a mean scaled score of 678 (32nd percentile), R-class students had a mean scaled score of 661 (22nd percentile), and RA students had a mean scaled score of 673 (28th percentile). Similar results were found for **TCAP Total Language, Total Math, Study Skills, Science, and Social Science sub-scales** (See Appendix B and Appendix C).

To estimate benefits regarding race, an approximate analysis was conducted to identify any interaction of race with class type on the achievement measures. Complete and correct analysis of the data that would allow for the possibility of white and minority students in the same classroom, while still maintaining the control for classes (i.e. teaching styles, strategies, etc.), was unwieldy. However, the error term for the mean square classes-x-race-

x-class type was alternatively used because earlier work with these data indicated that the primary class-type interactions with race approximated the mean square for students within racial groups within classes. Even with this "liberal" analysis and the increased degrees of freedom, no multivariate tests were significant for the interactions of race with class type or for race with school location. Although Project STAR results on K-3 test scores indicated that the most significant S-class advantages were found with minority students, the LBS fourth-grade results showed that the positive effects of small classes were equally significant for minority and white students, in all school locations. **Table 5** shows that the S-class students always outperformed students from R and RA class types. There is a consistent difference between white and minority students that favors white students, but the S class is consistently higher for both groups.

Table 5

Lasting Benefits Study: Fourth Grade (1989-90)
TN Comprehensive Assessment Program (TCAP)
Mean Scaled Scores by Race and Class Type

ACHIEVEMENT MEASURES		CLASS TYPE			SCORE DIFFERENCE	
		Small	Regular	Regular/Aide	Small vs. Regular	Regular/Aide vs. Regular
Total Reading	White	714.00	710.16	707.42	3.84	-2.74
	Minority	685.89	676.08	676.00	9.81	-0.08
Total Language	White	718.89	714.53	713.95	4.36	-0.58
	Minority	696.78	691.76	690.03	5.02	-1.73
Total Math	White	715.52	711.39	708.83	4.13	-2.56
	Minority	694.49	687.68	687.43	6.81	-0.25
Science	White	720.43	715.96	715.71	4.47	-0.25
	Minority	690.39	682.09	677.86	8.30	-4.23
Social Science	White	725.52	721.78	719.03	3.74	-2.75
	Minority	696.08	683.90	684.91	12.18	1.01
Study Skills	White	702.24	694.76	693.50	7.48	-1.26
	Minority	663.01	647.15	642.38	15.86	-4.77

Summary and Conclusions

Project STAR results indicated substantial benefits for students in small classes. Similarly, LBS students who had attended small STAR classes had an educationally and statistically significant advantage over the LBS students who had attended regular or regular-with-aide STAR classes. S-class students outperformed students from R and RA classes on the six NRT sub-scales of the TCAP and across all four locations. Suburban S-class students achieved higher scaled scores than students from the other three locations. Benefits were greater for minority than for white students (R-S).

The achievement advantage for S-class students can be measured by the TCAP scaled-score differences between the S and R classes, and between the RA and R classes as shown in **Table 6**. Students from the S classes retained an academic advantage over students from R and RA classes. Although the S-class effect (STAR) leveled

off in the second grade, the positive effects from involvement in a S-size class still remain pervasive one full year after students returned to R-size classes (LBS). The class-size intervention effect may be expected to diminish in some subsequent school years and to reappear in others. Thus, longitudinal analysis is necessary. Use of Tennessee's nationally recognized STAR student data base to identify the continuing benefits of small classes and/or to understand any further diminishing effects seems important.

Table 6

Lasting Benefits Study: Fourth Grade (1989-90) TN Comprehensive Assessment Program (TCAP) Scaled Score Differences and the Differences in the Mean Number of Domains Mastered Between Small and Regular Class Students and Between Regular/Aide and Regular Class Students

ACHIEVEMENT MEASURES	TN MEAN SCALED SCORE	CLASS TYPE			SCORE DIFFERENCE	
		Small	Regular	Regular/Aide	Small vs. Regular	Regular/Aide vs. Regular
Norm-Referenced						
Total Reading	703	708.44	702.83	700.63	5.61	-2.20
Total Language	709	714.49	709.50	708.77	4.99	-0.73
Total Math	700	711.28	706.41	704.12	4.87	-2.29
Science	710	714.58	708.89	707.42	5.69	-1.47
Social Science	714	719.71	713.58	711.63	6.13	-1.95
Study Skills	686	694.65	684.55	682.40	10.10	-2.15
Criterion-Referenced						
Language Arts: Domains Mastered		4.12	3.87	3.69	0.25	-0.18
Mathematics: Domains Mastered		4.05	3.70	3.61	0.35	-0.09

The interpretation of the importance of the difference in test scores depends on the variability of the measures calculated. Effect sizes which are the differences between the mean scores of S and of R classes (or RA and R classes) divided by the standard deviation of the R class were calculated in the LBS analysis. **Table 7** provides estimates of the S class and RA class effect sizes. It shows effect sizes ranging from .11 to .16 for the S/R contrast. The RA/R contrast shows effect sizes ranging from -.02 to -.09.

The absence of a statistically significant teacher/aide effect is consistent across all measures. Although the inner-city RA students scored equal to or higher than inner-city R students on every achievement measure, differences were not statistically significant. The RA students made somewhat higher scores than R students in three other instances: in the rural location on Total Language and in the urban location on Study Skills and Social Science. Again, the differences were not statistically significant.

Table 7

Lasting Benefits Study: Fourth Grade (1989-90) TN Comprehensive Assessment Program (TCAP)
Summary of Estimates of Small Class and Regular/Aide Effect Sizes

Achievement Measures	Small vs. Regular Contrast	Regular/Aide vs. Regular Contrast
Norm-Referenced		
Total Reading	.13	-.05
Total Language	.13	-.02
Total Math	.12	-.06
Science	.12	-.03
Social Science	.11	-.04
Study Skills	.14	-.03
Criterion-Referenced		
Language Arts: Domains Mastered	.11	-.09
Mathematics: Domains Mastered	.16	-.04

The statistically significant advantages for LBS fourth-grade students who had been in STAR third-grade small classes form a strong pattern of consistency. S-class students outperformed R and RA class students on every achievement measure in all four school locations. The Lasting Benefits Study which continues to build on the nationally recognized STAR project database will provide important data and information for making educational policy decisions.

Some Speculative Conclusions

Students in early primary (K-3) grades benefit from being in small (e.g., 15:1) classes. The STAR results (Word et al., 1990) suggest that the greatest gains accrue in the early grades (K,1). These results are not unlike results from some preschool and Headstart evaluations (e.g., Schweinhart, 1984; Weikard, 1989; Weikard et al., 1974). Given limited resources (a variable that unfortunately must be considered), administrators should not assign all teachers/classes the same numbers of students. Classes in early primary (K,1) should be small (15:1) since the benefits gained from small classes by the end of first or second grade will likely continue in later years (Nye et al., 1991; Weikard, 1989). Thus, somewhat larger classes (e.g., 22:1-1:25) may be feasible in later grades.

It is possible that "Lasting Benefits" would be more pervasive if teachers who receive students into the "regular" classes from the small classes had some training in at least two areas: 1) what to expect from these students, and 2) how to teach them effectively.

When provided with convincing data, teachers' associations will come to recognize the early-primary small-class benefits for both student and teachers at all grade levels. Students (as shown by Project STAR) will learn better in smaller than in larger classes. They will come to the later grades (and larger classes) better prepared to continue learning. This should reduce problems for teachers in later grades.

The STAR and LBS studies provide strong examples of benefits of collaboration among various "actors" in education reform and improvement. Without the unflagging support of LEA personnel (not just letting the study "happen", but actually getting involved), studies of these types (which use considerable teacher, student, and LEA administrative time) could not occur.

Potential for Further Analyses

There will be continuing analyses (longitudinal) of the lasting benefits from having been in a small class. Additional future studies developed from the STAR database could include studies of principal or leadership effects (the in-school design will allow for this analysis), studies of the effects of school size, and perhaps the interactions of class and school size. Since STAR researchers do have "comparison" schools from the same systems as the STAR schools and because the STAR classes were randomly assigned, it may be possible to study the effects of random vs. non-random assignments by using the comparison school data and the regular class data from the same district for the 20 districts that provided the comparison school data. (Comparison-school data were collected as an internal "baseline"; there were no manipulations in these schools.

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Appendix A.

Definition of School Types

The legislation specified that the project should include "inner city, suburban, urban, and rural schools" to assess the effects of class size in different types of schools. No existing designation of schools had used the categories specified above, so the consortium developed designations using various criteria.

Inner-city and *suburban* schools are all located in metropolitan areas. Schools that had more than half of their students on free or reduced cost lunch (indicative of a low-socioeconomic background) were tentatively defined as *inner-city*. Schools in the outlying areas of metropolitan cities were classified as *suburban*.

In non-metropolitan areas, schools were classified as *urban* or *rural* depending on the location of the school. If located in a town of over 2,500 population (the census definition of urban), the school was classified as *urban*. All other schools were classified as *rural*. All classifications were checked with local school officials to see if they agreed with the designation of their school.

Appendix B.

Lasting Benefits Study: Fourth Grade (1989-1990)
Mean Scores from the Tennessee Comprehensive Assessment Program (TCAP)

TCAP Total Reading

	Small	Regular	Regular /Aide
Inner-City	678.10	661.20	673.17
Suburban	717.88	706.67	700.95
Rural	709.67	706.32	704.41
Urban	703.80	700.08	697.59
All	708.44	702.83	700.60
White	714.00	710.16	707.42
Minority	685.89	676.08	676.00

TCAP Total Language

	Small	Regular	Regular /Aide
Inner-City	686.64	679.00	686.63
Suburban	722.54	713.06	709.73
Rural	715.24	711.37	711.93
Urban	714.98	712.12	702.83
All	714.49	709.50	708.77
White	718.89	714.53	713.95
Minority	696.78	691.76	690.03

TCAP Total Mathematics

	Small	Regular	Regular /Aide
Inner-City	692.77	677.41	686.77
Suburban	715.54	706.23	699.62
Rural	712.39	710.38	708.85
Urban	709.93	702.12	699.31
All	711.28	706.41	704.12
White	715.52	711.39	708.83
Minority	694.49	687.68	687.43

TCAP Study Skills

	Small	Regular	Regular /Aide
Inner-City	646.45	629.76	641.40
Suburban	704.43	687.61	679.09
Rural	697.49	690.26	688.75
Urban	695.38	678.60	687.27
All	694.65	684.55	682.40
White	702.24	694.76	693.50
Minority	663.01	647.15	642.38

TCAP Science

	Small	Regular	Regular /Aide
Inner-City	677.18	668.03	670.07
Suburban	719.84	709.51	705.99
Rural	717.73	714.04	713.66
Urban	714.41	703.19	701.02
All	714.58	708.89	707.42
White	720.43	715.96	715.71
Minority	690.39	682.09	677.86

TCAP Social Science

	Small	Regular	Regular /Aide
Inner-City	685.81	673.93	680.95
Suburban	725.37	712.03	708.66
Rural	721.84	719.47	717.14
Urban	722.78	709.79	710.15
All	719.71	713.58	711.63
White	725.52	721.78	719.03
Minority	696.08	683.90	684.91

Appendix C.

Figures 1-6
Graphical Representation of
TCAP Fourth Grade Results

Figure 1

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Reading: Class Type by School Type

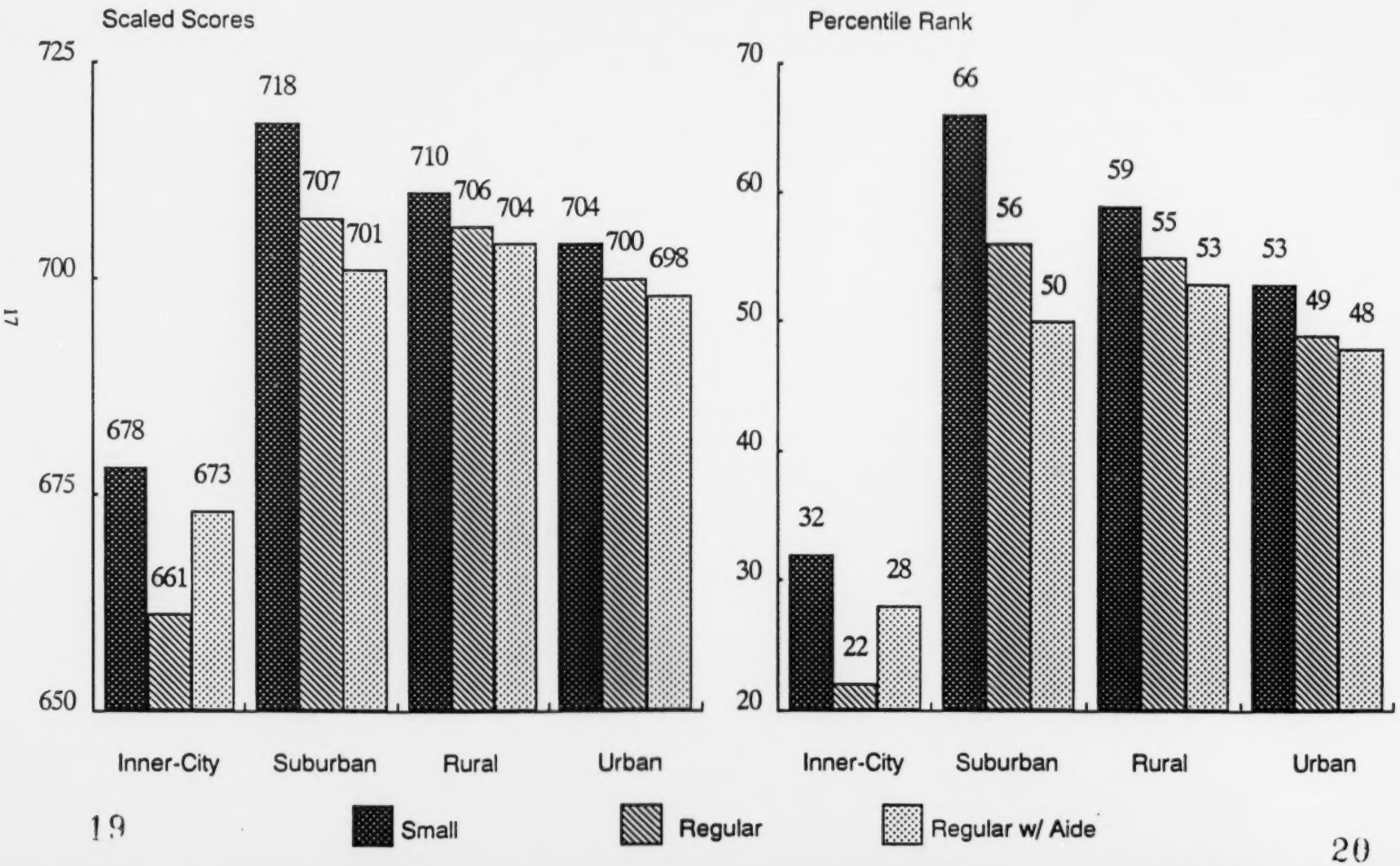

Figure 2

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Language: Class Type by School Type

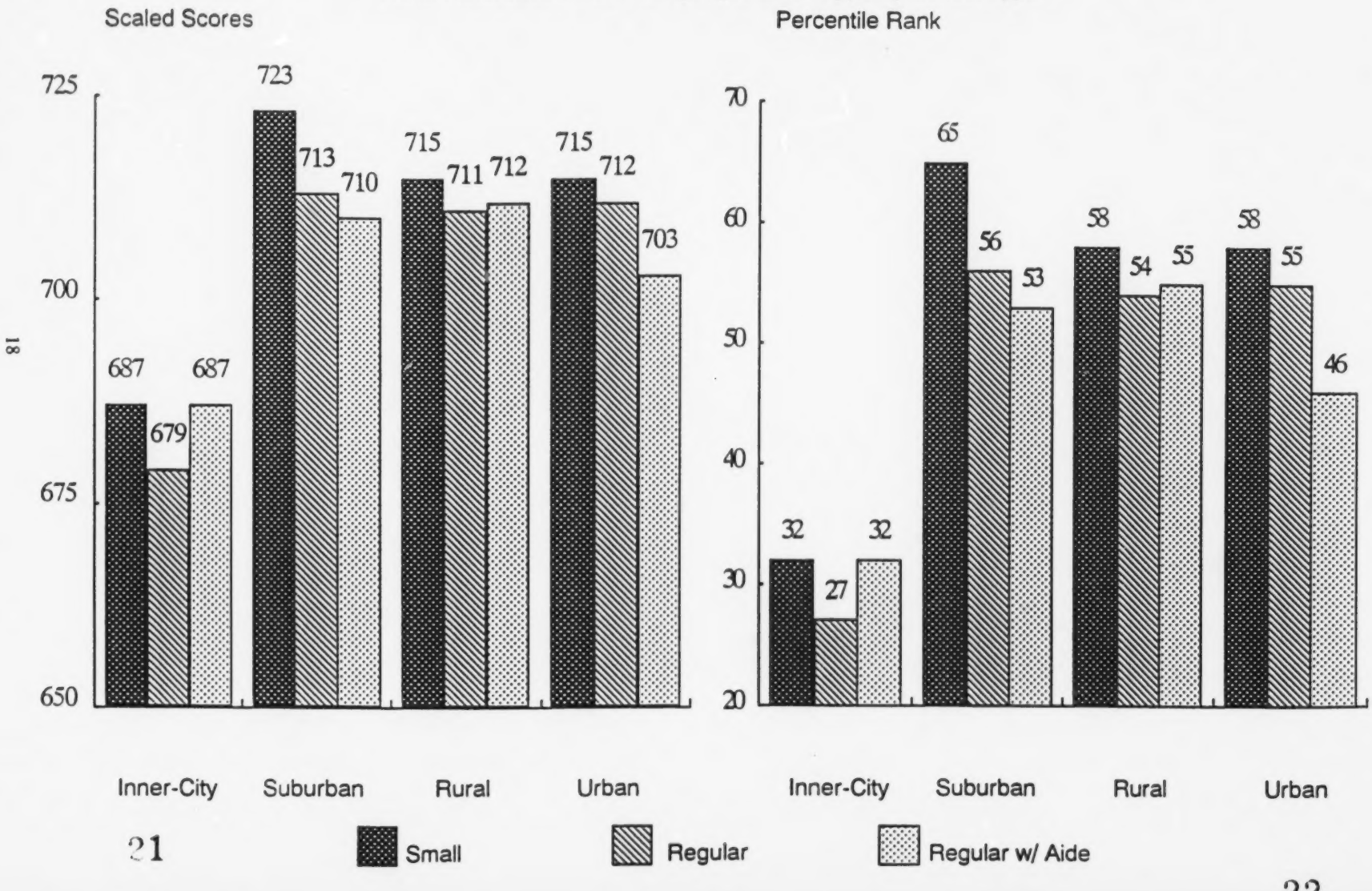

Figure 3

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Math: Class Type by School Type

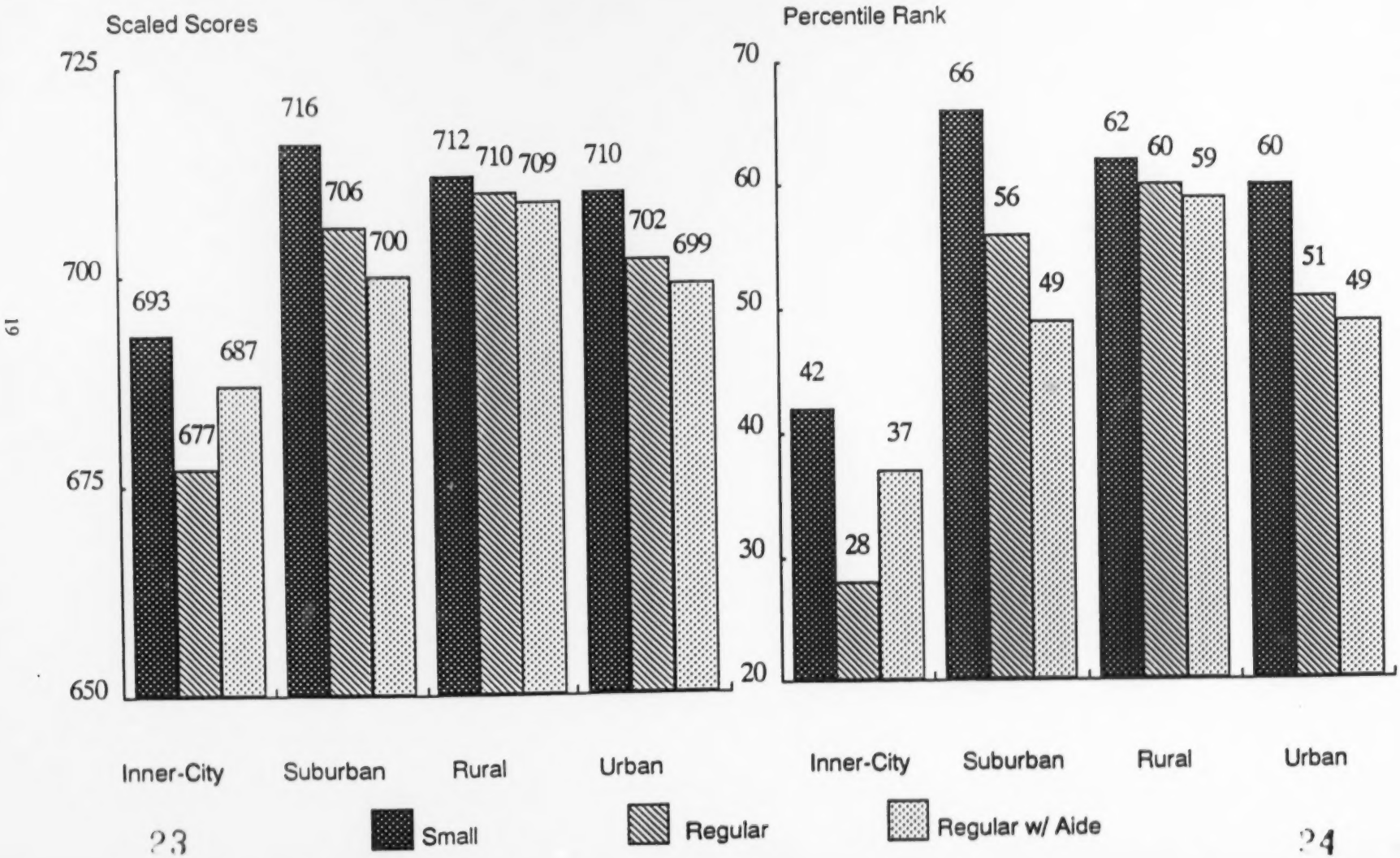

Figure 4

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Study Skills: Class Type by School Type

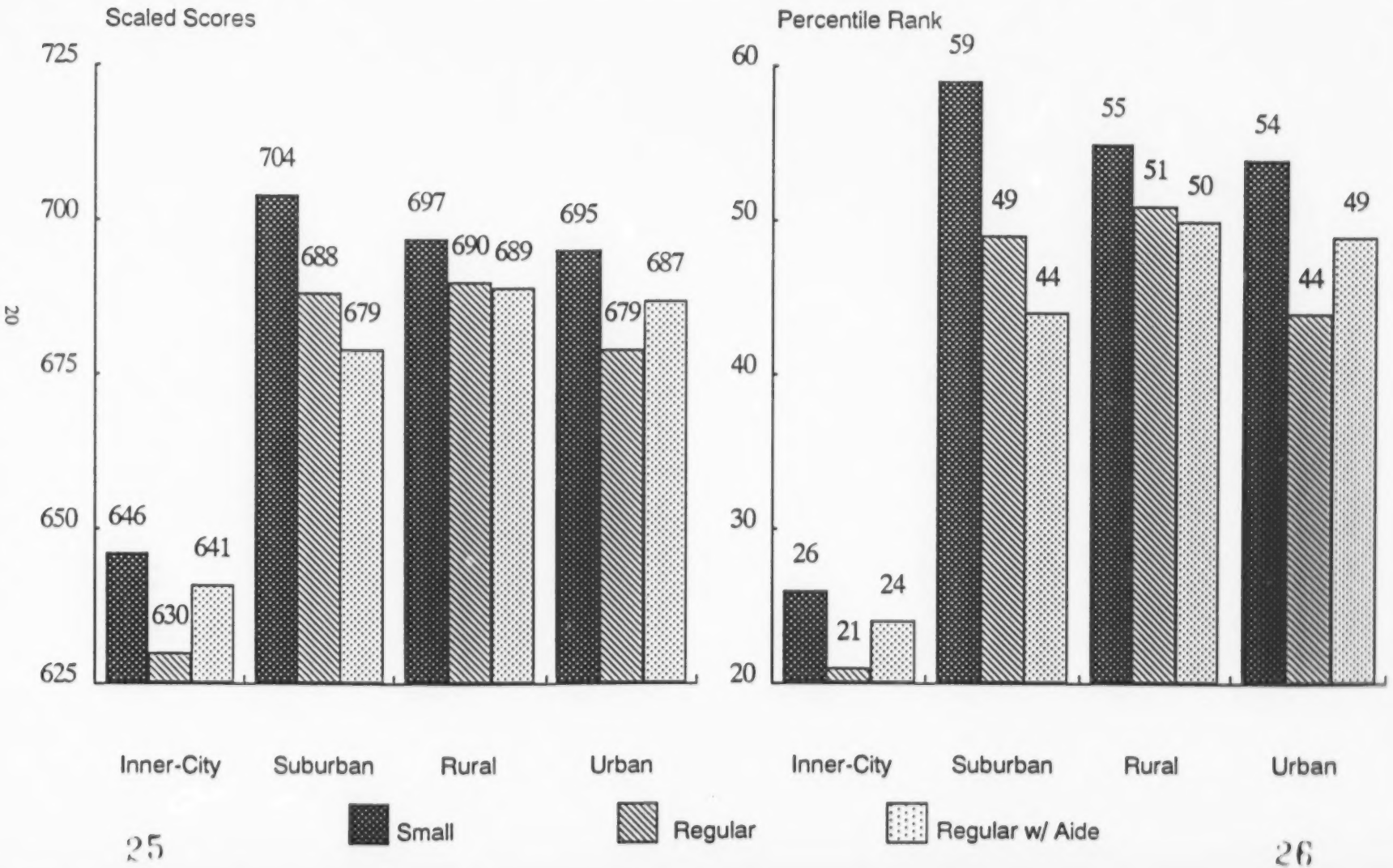

Figure 5

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Science: Class Type by School Type

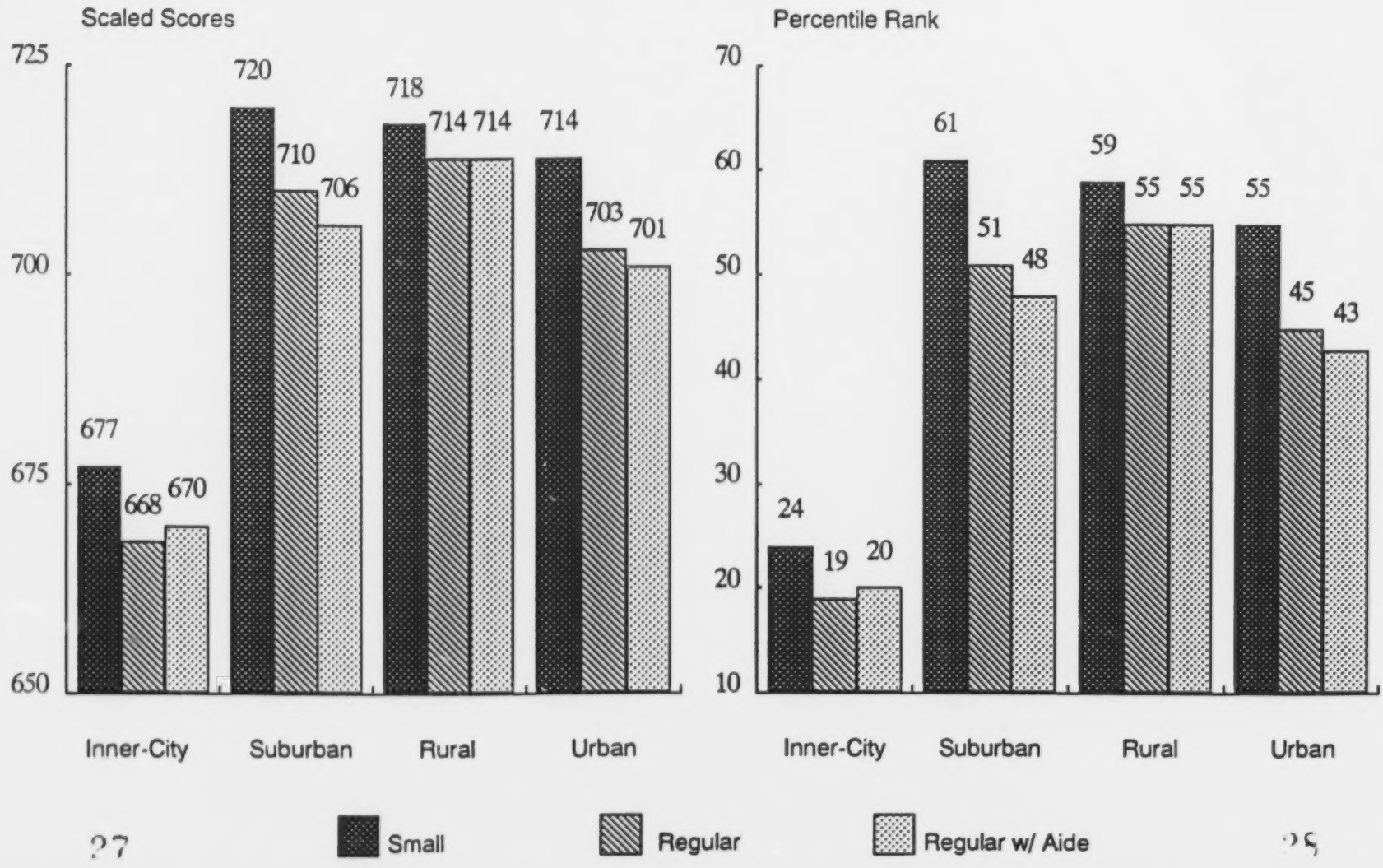

Figure 6

Lasting Benefits Study: Fourth Grade (1989-90)
Tennessee Comprehensive Assessment Program (TCAP)
Norm-Referenced Total Social Science: Class Type by School Type